Testimony before the
House Government Reform Committee, Subcommittee on Energy and Resources
United States House of Representatives

"Petroleum Refineries: Will Record Profits Spur Investment in New Capacity?"

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A Statement by

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DISCUSSION OF REFINERY CAPACITY ISSUES

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Thank you Mr. Chairman and Committee Members for this opportunity to appear before you. I have been asked to address 3 specific areas: the outlook for global refinery capacity changes over the next 5 years, the risks and concerns with this investment pattern and the role and source of imports over the period.

As background, I am a project manager with ICF Consulting in Fairfax, Virginia. ICF Consulting is a large consulting company specializing in energy, environmental, homeland security and transportation issues on a global basis. We have performed work for many Federal, State, and local public entities, including as examples DOE, EPA, MMS, as well as the California Energy Commission and other State groups. We supported the DOE in managing the Strategic Petroleum Reserve, and in establishing the Heating Oil Reserve, and are currently the primary contractor supporting the Natural Gas STAR program for EPA.

My experience is over 30 years of operational and management experience in the oil industry, including responsibilities from trading and marketing crude oil, optimizing refinery operations, and in managing the downstream distribution system from the refineries to marketing terminals. I have been directly involved in dealing with supply disruptions due to severe weather, political actions, refinery outages, and implementation of changing product specifications.

Over the past two years, the price of crude oil and oil products has significantly increased. The reasons for the increase appear fairly clear. Global demands for products have been increasing, particularly in the Far East, but also in the U.S. In addition, it appeared that the available global surplus crude oil capacity was shrinking, with even Saudi Arabia being perceived to have limited spare supply.

As this situation continued to developed, we thought that the issue of global refinery capacity to convert crude oil into products was flying under the radar of many people. We believed that the rise in global demands was outpacing growth in refinery capacity, and that demands were showing little elasticity to the higher price levels in 2004 and earlier in 2005. Consequently, we developed an analysis of this situation and published a paper on the subject in early August to raise attention to the issue.

Unfortunately the disastrous impact of Hurricanes Katrina and Rita on the Gulf Coast has provided ample evidence of the critical importance of the refining and distribution infrastructure to the stability of both supply and prices.

In the testimony provided in this document, I will focus on the specific material requested, and will include additional information related to the subject for your consideration.

The testimony below is presented in the following order:

1. Global Demand History and Outlook
2. Global Refinery Capacity History and Outlook
3. The Shrinking Surplus Refinery Capacity
4. Refining Investment Patterns
5. US Capacity, Demand and Import Outlook
6. US Refinery Investment Issues
7. Outlook for Change
8. Summary

Global Demand History and Outlook

Global Oil demand history and forecast is presented on **Exhibit 1.** The demands presented are for total oil demand, including gasolines, distillates, jet fuel, residuals, LPG and so on. The demand data is from the International Energy Agency, IEA, and 2004 World Outlook. IEA is within a month of releasing their 2005 outlook, so the numbers presented here may be revised shortly. You will note that these are annual average numbers. Demand is typically higher in winter months due to seasonal heating oil demands by several million barrels per day. This factor can become important since historically inventories grow in the second and third quarters to be drawn through the winter. If refinery capacity is barely able to meet summer demand levels, then potential would exist for supply shortages in winter months.

Let's look at the same data from a volume and growth rate basis. In the early 1990's, global demands grew about 1.15% annually. In the last decade, demands grew about 1.8%. IEA is forecasting a growth rate of 1.65% over the next 5 years, and then increasing to 1.8% again to 2020. The additional demand level of about 23 million barrels per day between 2005 and 2020 is roughly equivalent to 100 world class size refineries.

Exhibit 2 shows the demand growth on a decade-on decade basis. While the growth rate forecast is fairly consistent at 1.65-1.8% since 1995, the demand has been accelerating over the past 25 years due to the higher base demand level and the development of economies in the Far East and the Third World. The summary box indicates that over the 40 year period from 1980 to 2020, demands increase substantially each decade. This is a very visible indicator that global demand for fossil fuels has been, and may continue to grow substantially. The demand acceleration is, in part, due to the relatively inefficient use of fossil fuels as new economies develop.

On **Exhibit 3**, I have focused on the growth patterns in the key enclaves of the US, Europe, and the Far East. For gasoline, Asia demands in the last decade have increased over 50%, and US demands have grown about 15%. Most notably, Europe gasoline demand has dropped about 5% due to continued dieselization of European demands for transportation fuels.

For distillates, however, the demand pattern is very consistent worldwide: continued and sustained growth. The bulk of this increase is in diesel fuels, and primarily for transportation needs. The importance of the trend to diesel and distillate growth is significant, since economic growth means commodities and goods must be transported

to markets. In addition, global trends to reduce sulfur levels in all fuels will particularly impact diesel markets and diesel supply.

Global Refinery Capacity History and Outlook

Exhibit 4 shows a longer term perspective on global refinery capacity. In the early 1980's, there was extraordinary global surplus capacity compared with demands. Through that period, many inefficient and smaller refineries were shutdown, and by the late 1980's global refining capacity was stable at about 73-75 MMBPD. In the early 1990's and through about 2000, refining capacity began to increase somewhat paralleling global demand increases.

On **Exhibit 5,** the focus is the most recent 15 year period. This shows the change in global refinery capacity from 1990 to 2004, compared to global oil demand. Capacity and demands are measured in millions of barrels per day. The trend shows that the ratio of refinery capacity to demand declined from 113% in 1990 to 103% in 2004. The reduction in surplus refinery capacity came despite continued growth in overall global refinery capacity. This was due to the demand acceleration factor discussed earlier. In addition, the prevailing margins for investing in large-scale refinery capacity projects simply did not exist over this period, and also for some less competitive refineries did not support major capital investments to meet emerging environmental requirements.

It should be noted that the refinery capacity which was shutdown in the 1980's and 1990's was primarily inefficient, small scale and technologically weak assets. The industry focused capital spending on making the strong refineries more competitive through better technology, energy conservation projects, and greater ability to run cheaper crude oil, and so on.

The larger drop in surplus capacity that occurred in 2004 was because of the large increase in demand in Asia above what many expected. This demand increase tightened markets globally as Asia looked to import additional products to meet demands.

Exhibit 6 estimates the future global growth in refinery capacity based on a number of factors. The numbers show that global capacity is expected to grow by just over 9 MMBPD by the end of 2010. This information is gathered from actual announced refinery projects which we judged to be credible, as well as an evaluation of annual growth in capacity of existing refineries.

Exhibit 7 shows the capacity growth from 2004 to 2010 in more detail. The growth is primarily centered in the Far East and Middle East. The US capacity growth is based on several announced expansions of existing refineries between 2005 and 2007, the construction of a proposed grass roots refinery in Arizona, and a possible large expansion of capacity in the 2010 time frame which is being studied by a major US refiner.

It is important to note that the time to engineer, permit, acquire materials, construct, and start up a refinery could take a minimum of 5 years, assuming fast track permitting, site construction approval, and environmental reviews. In the US, this could take longer due to greater likelihood of permitting delays. For example, the proposed Arizona refinery began permitting processes in 1999, and is still in that process today. Consequently, we

believe this forecast has no significant upside for more refining capacity before the end of 2010.

The Shrinking Surplus Refinery Capacity

Based on the global demand forecast, and the outlook for growth in refinery capacity, we can evaluate the outlook for available refinery capacity versus demands over the next 5 years. **Exhibit 8** maps the increased refinery capacity against the forecast for oil demand growth from the International Energy Agency in Paris through 2010. The key information on this exhibit is that the surplus refinery capacity ratio of 103% in 2004 stays the same and in fact becomes a bit tighter until finally showing some growth in 2010. However, even in 2010 it remains well below historical levels.

Exhibit 9 shows the impact of lower spare refining capacity on refining margins in the US and Europe. Margins have become clearly higher in 2004 and 2005 as the spare refining capacity ratio has been reduced. It should be noted that the 2005 data are average margins for 2005 through July. We excluded from this chart the current higher refining margins related to the disruption in refinery capacity due to Hurricanes Katrina and Rita.

There are several important messages that stem from this Exhibit. First, historical refinery margins had been chronically low through 2003, even though the global surplus capacity was being gradually reduced. When the global demands increased substantially in 2004, the surplus capacity declined and supply tightened. This caused margins to increase and they have remained high. Second, a number of the new refinery plans in the Far East and Middle East have been announced in the last 12 months. This is due both to the clear demand needs in that region and the emergence of higher refinery margins. The margin levels being seen pre-Katrina in 2005 can provide an acceptable return on new refinery capacity in those regions.

Refinery Investment Patterns

Global Refinery investment patterns over the past 5 years are shown on **Exhibit 10.** This Exhibit compares the growth in capacity of key refinery processes over the 2000 to 2005 time frame for both US and World refineries. The key information on this Exhibit is that there has been extraordinary growth in process expansions to reduce sulfur levels in products. This is seen from the increases in hydrotreating and hydrocracking capacity, as well as in sulfur production capacity. In addition, capacity to increase the ability to process heavier and cheaper crude oils through the “coking” process has been a major focus point.

On the other hand, Investment in Crude processing capacity has been very limited. The rationale to focus investment in sulfur reduction and heavy crude processing is simple. The sulfur reductions were mandated, and refiners had to decide to either invest to be able to manufacture merchantable products or to potentially close refineries. Investments in facilities to process heavier crude oils could allow refiners to improve their profits by reducing the cost of their raw materials. The economics of these decisions were far better than expanding capacity during a period when refining margins were too low to justify major capacity investment.

As noted earlier, in the last 12 months there has been a clear increase in new refinery capacity projects in several areas of the world. **Exhibit 11** identifies some of the driving forces for those investments. First, refining margins are clearly higher, as I've shown. Secondly, the refineries are being built in China, India and other Asia markets where economic growth, and demands for fossil fuels have greatly exceeded overall world growth. The commercialization of these areas is very likely to continue which is forecast to sustain high growth in oil demands for some time. In addition to being deficient in refinery capacity, these regions have shortages in the petrochemical manufacturing required to meet growing consumer demands for other non-fuel products developed as derivatives of the refining business. Hence these projects typically have petrochemical synergies.

Also, many of these projects are supported by the Government, and include collaboration with major exporting countries' National Oil Companies (NOC's) who have agreed to supply long term crude.

In addition, these projects can receive approval to proceed far quicker than a US project, and do not require the degree of regulatory technology needed to meet U.S. standards. These areas often also have lower labor costs. All of the above tend to make capacity projects in these regions more attractive to investors than a U.S. market.

U.S. Capacity, Demand, and Import Outlook

The U.S. outlook over the period from 1995 to 2010 for demands, capacity growth, and import requirements is summarized on **Exhibit 12**. We anticipate that U.S. imports will grow to roughly 3.4 MMB per day by 2010 from about 1.6 MMB per day in 1995. The 2005 import level is forecast at about 3 MMB per day, but may be higher due to the recent refinery outages. This import forecast assumes that the planned U.S. refinery expansions will occur, and that U.S. refineries will continue to run at the high utilization throughputs seen in recent years.

The forecast also assumes that U.S. demand for oil products will continue to grow at levels of about 1.5% per year through 2010.

Exhibit 13 shows a closer look at import levels over the 2000 to 2005 period. While overall product import levels increased by about 25 percent, gasoline imports have increased by just over 50 percent. This has been driven by the higher U.S. demands for gasoline over the period. The increase in gasoline imports from 2000 is more than 60% gasoline blendstocks. This may indicate increasing difficulty in overseas refiners being able to meet U.S. Tier II requirements for finished gasoline.

Distillate imports have declined slightly, with the Virgin Islands and Canada being the bulk of imported volume. Of particular note is that Europe has been a minimal at best source of distillate imports. Europe is short distillate fuel, in particular diesel, and it has not been economic to provide significant volume on a sustained basis. There are some discretionary heating oil cargoes that have moved on an economic basis in the winter, but this is only when relative market prices could justify it. Part of the decline from 2000 is reduced Jet fuel import requirements.

Also, there is also an increasing trend to import unfinished oils to process in U.S. refineries to increase gasoline and distillate production. This is a very positive indicator

that U.S. refiners are wringing all the production capability out of the US refineries. Refiners will work to move unfinished oils from overseas refineries which do not have enough capacity to turn their crude feedstocks into finished products. The growth rate from 2000 to 2005 has been over an 80% increase.

You will note that less than half of the total volume of oil imports has been directly for gasoline or distillate products. Apart from the unfinished oils, the balance of the imports have been for residual fuel, LPG, and other hydrocarbon products (e.g. asphalts, specialty oils, etc) which do not enter the transportation or heating fuel sectors.

The common thread in the disparate range of different products imported to the U.S. is economics. Product moves globally, in both finished, ready to market cargoes as well as unfinished products for refining into finished gasoline, based on the relative value of the product in different regions of the world. When prices are higher in the U.S., imported volumes rise as refiners and traders see better value for the product in the U.S.

The sources of the gasoline imports into the U.S. over this period have shown some change, as seen on **Exhibit 14.** Imports from Europe have increased by over 150% from year 2000 levels, with half of this increase being blending components. As noted earlier, Europe gasoline demands have in fact declined due to increased dieselization of the European transportation fleet. This has depressed the value of gasoline for Europe refiners and made the economics of shipping gasoline to the US more attractive. At the same time, there has been a decline in gasoline imports into the US from Latin America. The decline is from countries such as Venezuela and Brazil, who in general do not have as much capability to meet US gasoline sulfur levels since Tier II regulations were implemented. In addition, demands in South America have increased at a faster pace than the U.S., which is also causing less gasoline to be exported from that market.

The other major import sources of gasoline are Canada and the Virgin Islands, with much of this volume moving into the Northeast U.S. and Florida markets. This has been a relatively steady supply since 2001.

In looking forward, we see product import levels increasing by 10-15% in the 2005 to 2010 time frame to meet the expected increase in US demands. (See **Exhibit 15**) The absolute volume of increased imports is not at this point a logistics concern for the US, however, a greater concern is the fact that a number of the refineries who have exported to the U.S. may have increasing difficulty meeting the lower sulfur levels in U.S. gasoline and diesel fuels in 2006 and beyond. Although major exporters in Canada, the Virgin Islands and Europe have adequate capacity to lower sulfur levels, refiners in South America and other regions may have even more difficulty than in the last five years. This impact, coupled with the high demand growth for gasoline and distillates in the Far East and Latin America may pull product from the U.S. even from our traditional “local suppliers” such as Canada and the Virgin Islands.

The impact of energy conservation actions in the U.S. will directly translate to lower imported product requirements. Where surplus global product moves will be dictated by market economics, including prices in different regions, relative freight costs to move product, and demand changes. The market will drive the movement.

Finally, we also anticipate that much of the imported volume increase in the next 5 years will be for gasoline components as well as unfinished oils. The changing product

specifications globally are likely to cause some refiners to have more surplus unfinished oils, which may be discounted versus U.S. product prices.

U.S. Capacity Investment Issues

Decisions to invest in large scale or grass roots refinery expansions are difficult and risky (See **Exhibit 16**). The capital investment required can be from $5 to $7 Billion dollars or more depending on the refinery size, location, complexity, and regulatory requirements for the facility. The financial exposure to the company building the refinery is very high because of the potential, and probability, of delays in getting permitting at local, State and Federal levels. Furthermore, the timeline from a decision to move ahead to completion of the refinery can be extraordinarily long in the United States, at least 5 years and possibly much longer.

While margins are good today, as noted earlier, actual margins when the refinery is finally operational can be very different. Historical refiner margins have been more often weak than strong. And margins are very sensitive to the fact that global oil demand growth can slow or plateau due to either a recession or major conservation initiatives. The fact that we are already seeing trends to lower SUV sales and higher demand for hybrid vehicles is a possible indicator of this.

In the U.S., the economic hurdles are higher than overseas projects for several reasons. Time to construct is longer due to the extensive engineering and modeling work needed to achieve permits. Local siting issues can create additional delays. Labor costs are higher than overseas, and the overall U.S. economy is more mature than areas such as China. This influences demand certainty and the possible benefits of petrochemical project integration that are more viable in growing economies.

In addition, the more sophisticated technology required within the refinery to meet U.S. environmental regulations increases the capital requirements for the investors.

The Energy Bill passed in August provides some benefit by allowing 50% of capacity-expansion capital to be expensed upon project completion. This change could be more beneficial if the expensing could be done as the funds are spent, given the extensive time line required for completion.

Outlook for Change

As noted in the discussion of refinery capacity growth, it is very unlikely that the forecast of refinery capacity through 2010 can increase significantly in the U.S. or the world. If anything, the forecast is an optimistic outlook of future refinery capacity, since all major projects of this nature…in the United States and outside…are complex, expensive, and challenging to complete on time.

In our opinion, this will mean a sustained period of very tight supply, periodic disruptions, and higher prices unless demand growth slows. There are several actions that may be considered to help mitigate the refinery capacity shortfall over the next 5 years. These are highlighted on **Exhibit 17.**

The first and most critical is to re-double efforts to educate U.S. Consumers. The DOE's Energy Hog program is a good start. In addition, consumers must understand that the

cost of energy is driven by supply and demand, and that the most critical element that consumers can influence is demand. The only benefit of the current high price levels for oil products, as well as natural gas, is to raise the awareness of the need for energy conservation initiatives on personal, family, business, and public levels. This is a very substantial benefit.

Second, the actions taken by the Oil industry, the EPA, the President, and others in the wake of the hurricanes to release volume from the SPR and the IEA reserves, waive the Jones Act, provide temporary relaxation of environmental specifications, and import tariff relief all assisted in providing additional supply and assurance to oil markets. These actions were taken quickly, with little publicity and showed good collaboration. It would make sense to explore further contingency plans to protect vital transportation assets (e.g. pipelines), and to perhaps convince Industry to hold additional days supply product in inventory.

As a current example, it may be helpful from a supply and price perspective to consider either modifying the timetable to implement and enforce Ultra Low Sulfur Diesel requirements (currently June 2006), or providing a period of time to make the specification enforceable at the refinery level, rather than at the terminal level. This will allow time for the U.S. distribution system to fully address the likely product degradation issues without jeopardizing consumer supply.

Third, the boutique fuels issue should be streamlined to better enable companies to utilize tankage and respond to disruptions. This will involve collaboration between several layers of government and the industry. Movement toward common global specifications for products would also be helpful, but will not happen without it being championed by governments and key agencies like IEA, EIA and others.

Fourth, identify obstacles in the permitting process for refinery investments, including site approval issues, permit application processes, and so on to enable refinery projects to be constructed in a timely manner with no loss in environmental assurance. In other words, smooth the path for refining investments, including a long term policy that identifies regulatory requirement timings clearly and well in advance so that Industry can invest with firm footing, streamlined permitting and siting processes, and tax benefits consistent with other capital intensive industries.

Fifth, although the impact would be longer term, clear and substantive improvements in CAFÉ standards for all automobiles, SUV’s and trucks should be put in place (including diesel engines).

Finally, all the above initiatives, as well as some of the current proposals before the Congress, should be carefully (but quickly) studied to ensure that the full costs and benefits of each are understood. A key part of that assessment would be the impact on supply of the actions being taken.

Summary

In summary (**Exhibit 18**), our outlook for global product supply over the next 5 years is for continued tight supply and exposure to price spikes due to periodic supply disruptions. The US can expect higher import requirements, and the competition for

imports globally will keep refining margins high until the global surplus capacity improves. This will likely be in the 2011-2015 timeframe.

Additional new refinery projects will continue to be initiated in high growth overseas markets. US refiners will continue to grow refinery capacity, but are likely to be very wary of expensive and hard-to-approve grass-roots refinery capacity in the US due to the uncertainty of return to shareholders.

Actions on personal, corporate, and government levels to reduce energy usage can have a significant impact on both higher prices and import requirements that will mitigate both supply and price concerns. Consumer actions on demand can have a powerful leverage, and should not be underestimated.